

Appendix B

Organizing and Visually Displaying Data

We have devoted an entire appendix to organizing and visually displaying data in order to offer possibilities for ways to think about processing data. We will provide examples for both quantitative and qualitative data. In these pages you may find inspiration for your own creative ideas.

Quantitative Data

Quantitative data typically consist of numerical values that are analyzed statistically. Raw data need to be organized and displayed so that they begin to make sense. Organizing quantitative data in lists is a simple way to show what data you have. Figure B.1 shows how student scores on a mathematics test can be arrayed in order from highest score to lowest score. Figure B.2 shows how scores can be organized by range.

FIGURE B.1 *Student percentages on mathematics test*

Student Name	Percentage
Mary	100
Tom	96
Craig	92
Lou	89
Jeff	88
Sam	86
Tabatha	86
Freddie	79
Anne	77
Wil	70

FIGURE B.2 *Tally and frequency of scores on mathematics test*

Percentages	Tally	Frequency
90–100		3
80–89		4
70–79		3

Displaying numerical values in a graph helps the researcher to see and discuss results. Graphs can be used to compare scores and groups, show trends in data, show relationships between variables, and describe parts of the whole. The following are examples of types of graphic displays that are commonly used by action researchers.

Bar graph. A *bar graph* compares values across categories. Frequencies are indicated on the vertical axis, while lowest to highest rank-ordered scores are depicted on the horizontal axis. Figure B.3 illustrates the test scores of students on the horizontal axis and frequency of those scores on the vertical axis.

Line graph. A *line graph* is a line with markers displayed at each data value. It is similar to a bar graph. Figure B.4 illustrates the number of children enrolled in after-school activities in four different grade levels.

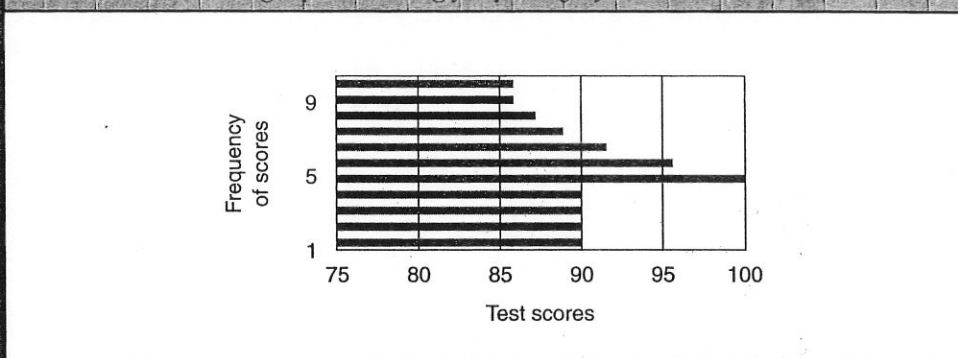
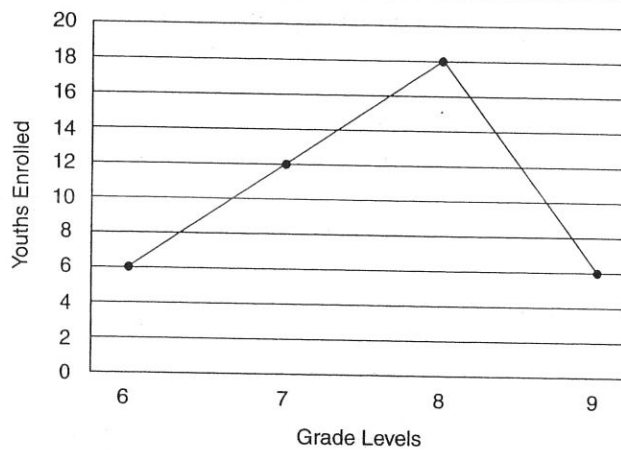
FIGURE B.3 *Bar graph showing frequency of test scores*

FIGURE B.4 Line graph of number of children enrolled in after-school activities in four grade levels.



Scatter plot. A *scatter plot* compares pairs of values and shows the relationship between two variables. The vertical, or *y*, axis indicates performance on one variable. The horizontal, or *x*, axis indicates performance on another variable. Each point is the intersection of two scores for each individual. Figure B.5 shows the relationship of students' scores on an examination and the number of hours they studied. The scatter plot indicates a positive relationship between the variables: students who studied longer had higher test scores.

Pie graph. A *pie graph* displays the contribution of each value to a total and is used to describe the parts of a whole in percent or the equivalent. Figure B.6 shows the percentage of students who favored each of four activities from a consumer science class.

Descriptive Statistics

When we want to summarize data (not generalize from them), we describe the data using the mean, median, mode, range, and standard deviation. Each of these calculations is briefly described.

Mean. The *mean* is the average, and it is computed by summing all scores and dividing by the number of scores.

FIGURE B.5 Scatter plot showing relationship between students' scores on an examination and the number of hours they studied

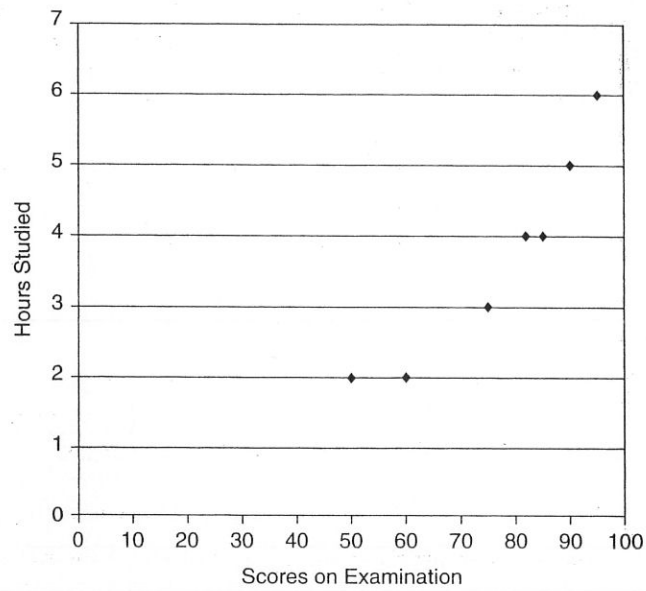
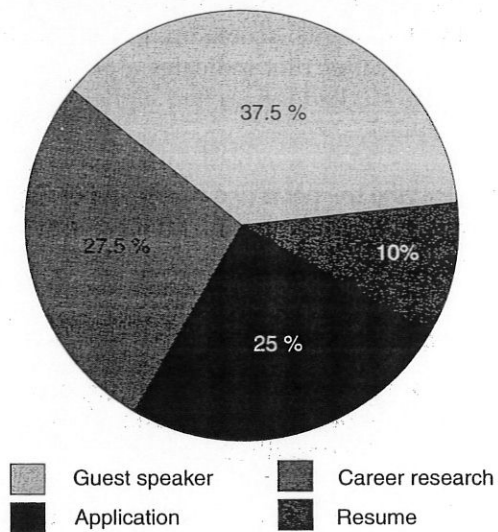


FIGURE B.6 Pie graph showing the percentage of students who favored each of four activities from a consumer science class



Median. The *median* is the midpoint in a series of scores. Fifty percent of the cases lie above the median, and 50 percent lie below the median.

Mode. The *mode* is the most frequently occurring score.

Figure B.7 illustrates the computation for the mean, median, and mode for a sample data set.

Range. The *range* is the span between the lowest score and the highest score. It is useful in summarizing the variability of scores. For example, using the raw data set from Figure B.7, we subtract 2 (the lowest value) from 9 (the highest value) and determine that the range is 7.

Standard deviation. The *standard deviation* is another measure of variability. It is the difference between a single score in a data set and the mean for the data set.

All the graphs and summary statistics described here can be easily calculated, displayed, and inserted into the body of your text by using spreadsheets that are included in most computer software packages. Displaying these summary statistics in a table makes it easy to see what is going on. Figure B.8 displays data from Rosie's Democratic Classroom Study in a table that shows the mean responses of students on the Citizenship Survey.

Choosing a Random Sample

When a researcher is studying an entire class, several classes, a team, a grade level, a time period, or multiage grouping, hundreds of pieces of student work may be generated. It is not always necessary to analyze *every* item. By choosing a *random sample* of the data, the researcher can obtain results that are comparable to analyzing the entire data set.

For example, suppose an action researcher wants to know if portfolios in her science classes are a viable alternative to giving students a final examination. While a rubric keyed to standards, concepts, or competencies can be used to assess student learning, as demonstrated in all the portfolios, it may be impossible to do an in-depth analysis of each. Instead of analyzing *all* of them, a mentor can help you

FIGURE B.7 Computation of mean, median, and mode for a sample data set

Raw data:	2, 4, 4, 6, 6, 6, 8, 8, 9
Mean:	$2 + 4 + 4 + 6 + 6 + 6 + 8 + 8 + 9 = 5.9$
Median:	2 4 4 6 <u>6</u> 6 8 8 9 = 6
Mode:	2 4 4 <u>6 6 6</u> 8 8 9 = 6

FIGURE B.8 *Citizenship Survey: means for student ratings of importance of characteristics of citizenship*

Characteristic of Citizenship	Number of Students	Mean
Knowledge of current events	17	3.6
Participation in community or school events	17	4.2
Performance of duties	17	5.0
Concern for others	17	5.3
Acceptance of authority	17	4.3
Ability to make wise decisions	17	5.7
Knowledge of government	17	4.0
Patriotism	17	4.2
Moral and ethical behavior	17	6.0

select a representative number from each class or group. But the question then becomes, Which ones to select? A fair way to select them may be *random selection*.

If, for example, you want to select 25 portfolios from the 200 completed in all your five classes, you begin by giving a number to each portfolio. Then you can use a scientific calculator or any number of computer programs to enter the number needed (25) and the set from which to draw (200); and the computer or calculator will print the numbers of the items to select. (If you saved that instruction booklet that came with your calculator, you'll be pleased now!) In the absence of technology, you can use the paper-in-the-hat method (a very technical system). Simply place the numbers of items into a hat, and draw out 25 numbers. No cheating—you can't put back the ones you don't like!

Qualitative Data

Qualitative data consist of the interview notes, descriptive observations written in your journal, and documents and artifacts that have been collected throughout a study. There are fewer restrictions on how these data are displayed and organized for analysis, and we will offer a few ideas to get things started.

Tables with words. Creating tables with words or concepts instead of numbers can be a useful way to begin analyzing and interpreting data. Figure B.9 presents excerpts from Lauren's journal, which contained her observations and comments from teacher colleagues about the relative benefits of a semitransitional groups (classroom divided in half and students in rows, each half facing the other half) ver-

sus cooperative groups (small, heterogeneous groups of students which are flexible depending on the nature of the task) in two sections of Spanish. She separated the data into positive and negative aspects. Lauren, a student teacher, decided that a flexible, heterogeneously mixed grouping of students was the optimal physical classroom arrangement for increasing student speaking in the target language.

Concept mapping. Concept mapping is useful for showing relationships. In Figure B.10 we include a concept map by Lori, another student teacher, who wanted to understand student views on strategies she used to help them perform better on tests in her honors chemistry class. She also interviewed teachers to find out what they thought of the tests and students' performance on them. In both cases, she quoted what the students and her teachers said.

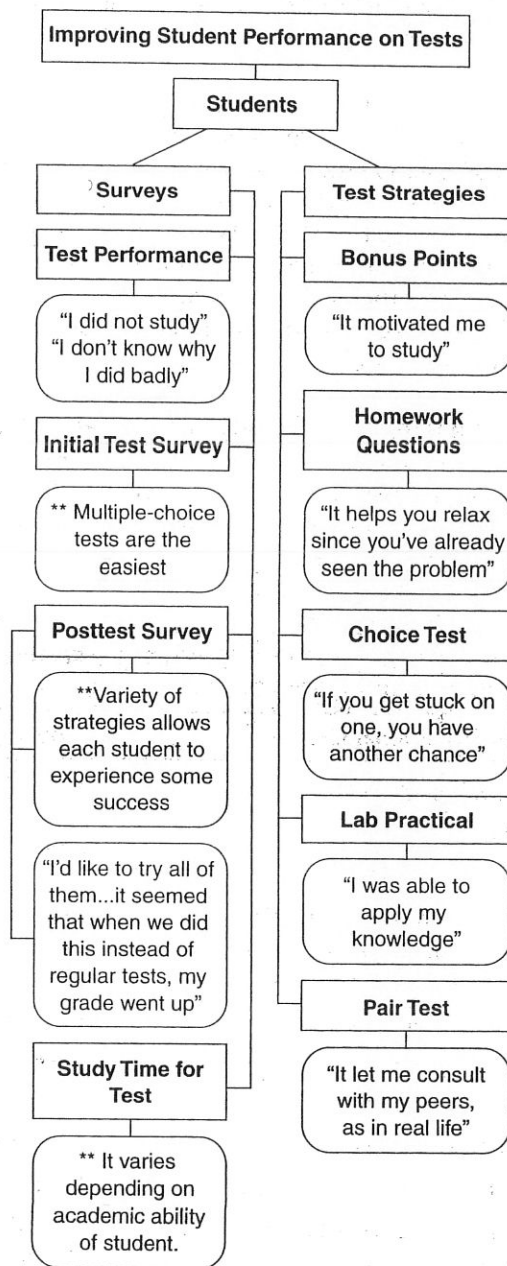
Lori concluded that students viewed different strategies differently and that she would have to accommodate different needs over the course of the term to ensure each student's success.

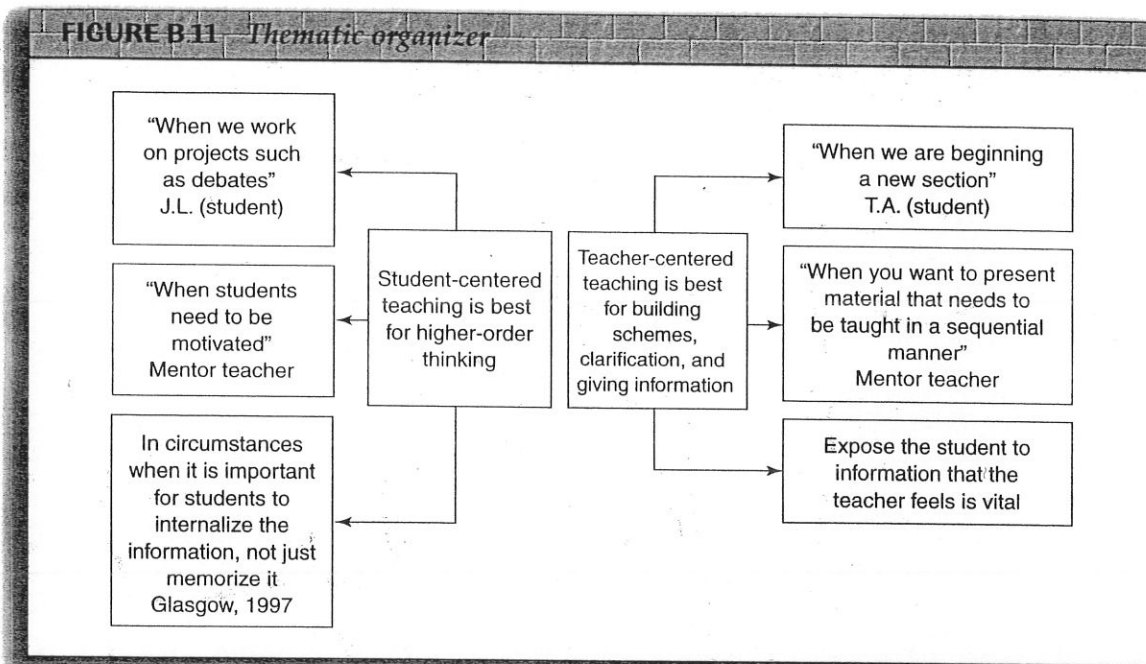
Thematic organizer. After analyzing his data related to when it was most appropriate to use teacher-directed and student-directed teaching, Matt used quotes from students, his mentor, and the professional literature to illustrate two themes that emerged. (See Figure B.11 for an excerpt of his analysis.)

FIGURE B.9 *Comparison of semitraditional and cooperative groups in a foreign language classroom*

	Semitraditional Groups	Cooperative Groups
Positive Aspects	<ul style="list-style-type: none"> More controlled Quieter Better for quizzes Can cover more material Easy to transition to other activities Students are on task 	<ul style="list-style-type: none"> Positive energy More student talk Students take an active role Increased student interaction Less downtime during oral assessments Opportunities for peer teaching
Negative Aspects	<ul style="list-style-type: none"> More teacher talk Students tune out Boring Students can be passive observers More teacher-centered 	<ul style="list-style-type: none"> Noise Requires more planning Students don't always use target language Bad for test taking Students distracted by others

FIGURE B.10 *Concept map of student views of instructional strategies designed to improve performance on chemistry test.*





Snake chart. Andrew wanted to show how he went about his action research project and what he learned along the way. He did this by mapping the progress of his study of cooperative learning groups in his social studies classroom from start to finish. (See Figure B.12.)

To summarize the steps she took in her study of helping students to learn the scientific method, Trish created a snake chart that showed the problems she introduced to her science students, what her students learned and did not learn, and what steps she took in her teaching to address the issues that arose. (See Figure B.13.) Both Andrew's and Trish's snake charts were used in presenting their study to other student teachers at the end of the term.

Other ways to organize data and show relationships include classification, cause-effect, and sorting. Several sources may be helpful in visually displaying data: Miles and Huberman (1994), *Qualitative data analysis*, and Hyerle (1996) *Visual tools for constructing knowledge*.

FIGURE B.12 Andrew's snake chart showing the development of his cooperative learning study

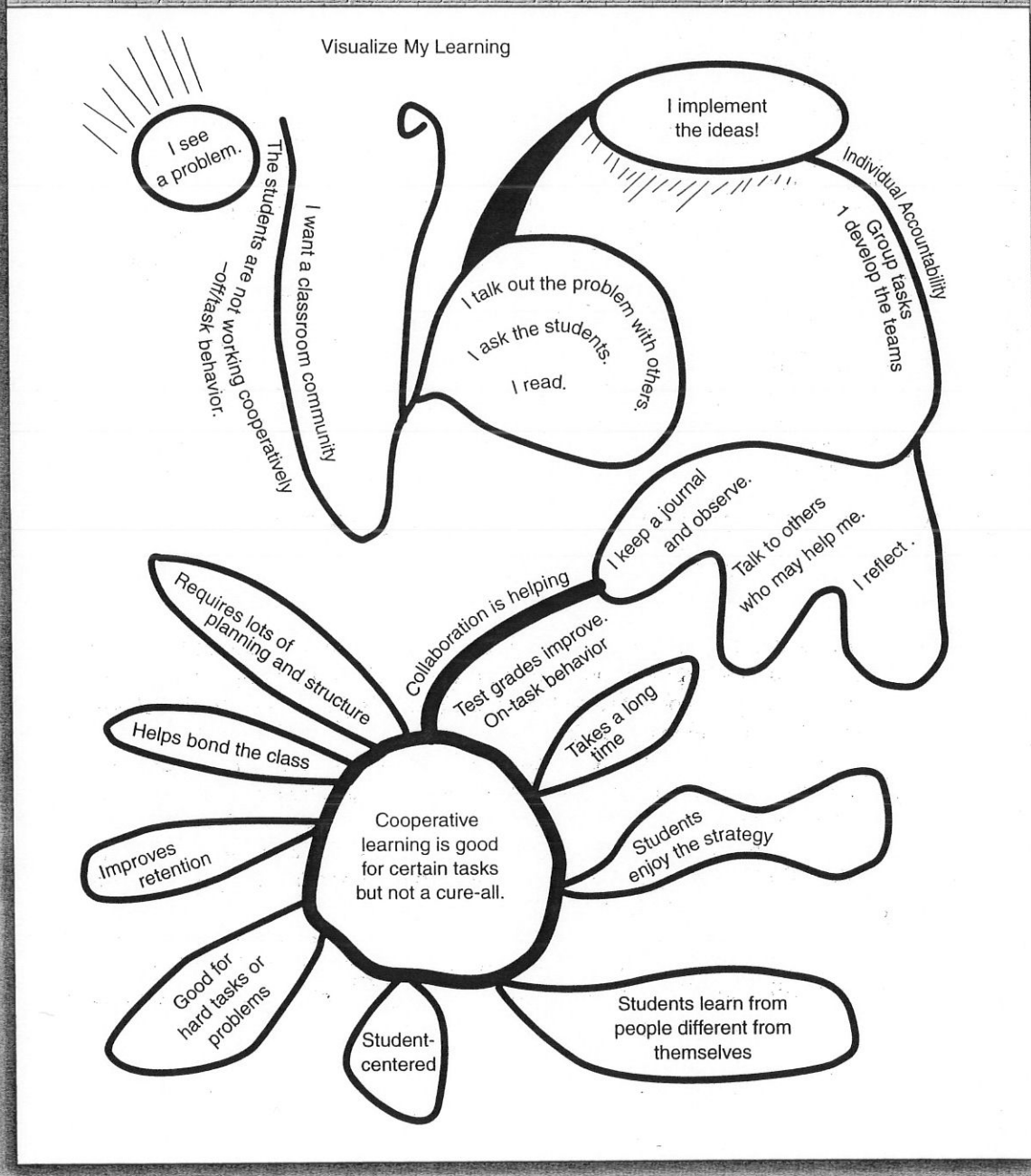


FIGURE B.13 *Trish's snake chart of teaching the scientific method*

